Exemption No. 5436

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
RENTON, WASHINGTON 98055-4056

In the matter of the petition of

BOEING COMMERCIAL AIRPLANE GROUP

Regulatory Docket No. 26649

for an exemption from § 25.562(b)(2)

GRANT OF EXEMPTION

By letter of August 13, 1991, Mr. John A. Miller, Chief Engineer, Airworthiness, 777 Division, Boeing Commercial Airplane Group, P.O. Box 3707, Seattle, WA, 98124-2207, petitioned for exemption from the floor warpage testing requirement of § 25.562(b)(2), as amended by Amendment 25-64, of the Federal Aviation Regulations (FAR), for flight deck seats on the Boeing Model 777-200 airplane.

Section of the FAR affected:

Section 25.562(b)(2), Amendment 25-64, requires the floor tracks used to attach the seat to the floor to be misaligned with respect to the adjacent seat tracks by at least 10 degrees vertically (i.e., out of parallel) with one rolled 10 degrees. The misalignment is used during the forward loading dynamic test condition and applies to both crew and passenger seats.

The petitioner's supportive information is as follows:

> "The Boeing Model 777-200 is the first aircraft that will be required to comply with FAR 25.562 (Amendment 25-64). There are certain provisions of FAR 25.562 which will create an economic disadvantage for the 777, relative to the aircraft it will compete against, without a commensurate increase in safety.

"Specifically, FAR 25.562 states: '...Where floor rails or floor fittings are used to attach the seating devices to the test fixture, the rails or fittings must be misaligned with respect to the adjacent set of

rails or fittings by at least 10 degrees vertically (i.e., out of parallel) with one rolled 10 degrees.'

"The preamble to Amendment 25-64 states: 'Crash investigations have shown that localized cabin floor deformation can occur in survivable crashes. This has been confirmed by the controlled impact demonstration and drop tests involving transport category airplanes. The inability of some seats to accommodate such deformations, remain in place, and restrain the occupants can contribute significantly to the degree of injury during a crash. The simulated floor deformation used in the dynamic tests. . . .will demonstrate the tolerance of the seat and its attachments to deformations that could occur in an actual crash.'

"The preamble also states the benefit of this amendment is believed to be that. . .some lives are expected to be saved that otherwise may not have been.'

"This test requirement makes no distinction between passenger and crew seats, while the evidence mentioned in the preamble is believed to be based on passenger seats only. There is evidence to suggest that floor warpage has not been a significant factor in flight deck seat failures during survivable crash conditions.

"The FAA acknowledged in the preamble to Amendment 25-64 the likelihood of seats designed to meet this amendment costing more to manufacture and therefore to purchase as well as increasing the airplane operating cost due to a weight increase. In order to justify the increased costs, it must be expected that some lives will be saved that otherwise may not have been. This does not appear to be the case for flight deck seats. These increased costs will create an economic disadvantage for the 777 without a commensurate expectation of saving lives that otherwise may have been lost.

"Accordingly, Boeing requests exemption of the Model 777-200 flight deck seats from the rail misalignment and roll test requirements of FAR 25.562 (Amendment 25-64).

"Granting of this exemption is in the public interest because it will:

1. Not adversely affect flight safety.
2. Improve the efficiency of the Model 777.
3. Tend to reduce air transportation fares.
4. Improve the potential for sales to foreign operators, which in turn improves the U.S. balance of payments."

A summary of the petitioner's August 13, 1991, request for exemption was published in the Federal Register on October 22, 1991 (56 FR 54604). One commenter responded to the notice. The commenter opposes the intent of the petition and believes granting of the petition will degrade the level of safety testing done on cockpit seats. It is the commenter's view that the

flight deck floor is prone to bending and twisting from a survivable crash landing, and it will receive high initial crash loads and be deformed as the loads exceed the ultimate strength of the structure. The commenter asserts that for this reason the seats must be dynamically tested with floor warpage and seat track roll. The commenter is also concerned that the head strike envelope of the pilot would be altered without the seat track pitched and rolled 10 degrees, and the decreased head strike envelope associated with granting the petitioner's request would increase the likelihood of the pilot suffering a deadly head strike. The commenter cites evidence from two recent accidents on narrow body airplanes to contradict the petitioners supposition that the flight deck floor is not subject to bending and warpage. It is the commenter's view that the reasons supporting the original interpretation of the regulation remain relevant.

The Federal Aviation Administration's analysis/summary is as follows:

> The petitioner's request for relief from the requirement to misalign the seat tracks is limited to the Boeing Model 777-200 flight deck seats. These seats are individually mounted single seats with both vertical and horizontal adjustments to accommodate the differences in the size of crewmembers. Crew seats are required to be fairly rigid in order to withstand the pilot reaction forces from the flight controls. While it is conceivable that too much flexibility in the seat mounting structure could interfere with the safe operation of the airplane, some flexibility in the seat attachment is considered necessary to conform to likely floor distortions during crash conditions.
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> The costs associated with the requirement to accommodate 10 degrees of track misalignment would fall primarily on the seat manufacturer in the form of developmental costs. The added weight and maintenance costs associated with the current rule should not be significant factors where only two seats per airplane are involved.
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> It is the commenter's view that the flight deck floor is prone to bending and twisting from a survivable crash landing, and as primary structure it will receive high initial crash loads and be deformed as the loads exceed the ultimate strength of the structure. The commenter cites evidence from two recent accidents on narrow body airplanes to contradict the petitioner's supposition that the flight deck floor is not subject to bending and warpage. The FAA considers complete floor failure or complete seat failure are the more common modes of failure in flight deck crew seats on narrow body and larger airplanes. Even with distortion in the floor, the crew seats remained attached in the two accidents cited by the commenter. Most of the observed failures during crash conditions are considered outside the dynamic test envelope envisioned by Amendment 25-64 and therefore are not considered survivable accidents. Amendment 25-64 was intended to correct observed design deficiencies in seats and seat restraint systems. There was no intention of restraining the seat beyond the ultimate strength of the structure.

The FAA agrees with the commenter that performing dynamic tests on pilots seats with 10 degrees of floor warpage and track roll would alter the head strike envelope. There are several potential head impact areas in the cockpit. For certain configurations, testing with floor warpage could give unrealistic indications of head injuries. Warping seats which have narrow bases (9 or 10 inches) places the pilot's upper torso and head in an unrealistic initial position. It could even be unconservative by virtue of placing the pilot's head closer to the object, resulting in a lower indicated value of the head injury criteria (HIC). Even if floor distortion should occur late in the impact pulse during actual crash conditions, due to inertial forces the pilot's head strike area should not be significantly altered. The FAA therefore considers the more realistic head strike path should start from the upright position. This constitutes a compromise between realistic HIC evaluations on airplanes having a low probability of significant floor distortion, and dislodged seats on smaller airplanes having a higher probability of floor distortion. This interpretation will provide pilots with the same level of safety afforded any other passenger in the airplane and is consistent with the original intent of the rule.

The commenter believes that the petitioner provides no substantiation for allowing relaxing of the regulation. The commenter refers to a comment he made to the docket during the original rulemaking that formed Amendment 25-64 that specifically recommended the dynamic testing of all seats in all the test conditions. The FAA concurred with this position based on the information available at the time. Since issuance of Amendment 25-64, the FAA has had the opportunity to review in detail the performance of crew seats under various crash conditions. Although some cockpit floor distortions have been observed, there has not been a problem with flight deck seat separations due to floor buckling on narrow body and larger airplanes.

The commenter requests the FAA make public the performance of crew seats under various crash conditions. He references the March 8, 1990, letter from Anthony Broderick to Mr. K. D. Draper, IPECO EUROPE LTD. The commenter asks that the specific accidents and evidence from these accidents be made public before the decision is made to grant this exemption. The FAA has no control over the official public release of the NTSB accident report, which is the only official accident report. The FAA, however, reviewed the cockpit floor on these airplanes and concludes that the seats performed as expected.

The FAA has reviewed the arguments presented by the petitioner in support of the exemption and concludes that the service history of flight deck seats on larger airplanes supports the petitioner's request. Although some cockpit floor distortions have been observed after accidents, there has not been a problem with flight deck seat separations due to floor buckling on narrow body and larger airplanes which have a minimum of 40 inches of frangible structure between the flight

deck floor and the lower fuselage contour. The FAA now considers that requiring testing of pilot seats with floor warpage cannot be justified on narrow body and larger airplanes. The FAA is currently developing a proposal to amend the regulations accordingly.

In consideration of the foregoing, I find that a grant of exemption is in the public interest and will not affect the level of safety provided by the regulations. Therefore, pursuant to the authority contained in §§ 313(a) and 601(c) of the Federal Aviation Act of 1958, delegated to me by the Administrator (14 CFR 11.53), the Boeing Commercial Airplane Group is hereby granted an exemption from the floor warpage testing requirements of § 25.562(b)(2). The following limitations apply to this exemption:

1. This exemption is limited to the Boeing Model 777 airplane and applies only to the crew seats on the flight deck. Flight attendant or passenger seats are not exempted.

2. The flight deck crew seats are exempted from compliance with the 10 degrees of track misalignment required under § 25.562(b)(2). Compliance with all other requirements of § 25.562 is required.

Issued in Renton Washington, on April 1, 1992.

/s/ Leroy A. Keith
Manager, Transport Airplane Directorate
Aircraft Certification Service